Multilayer GEM detector experimental and simulation results

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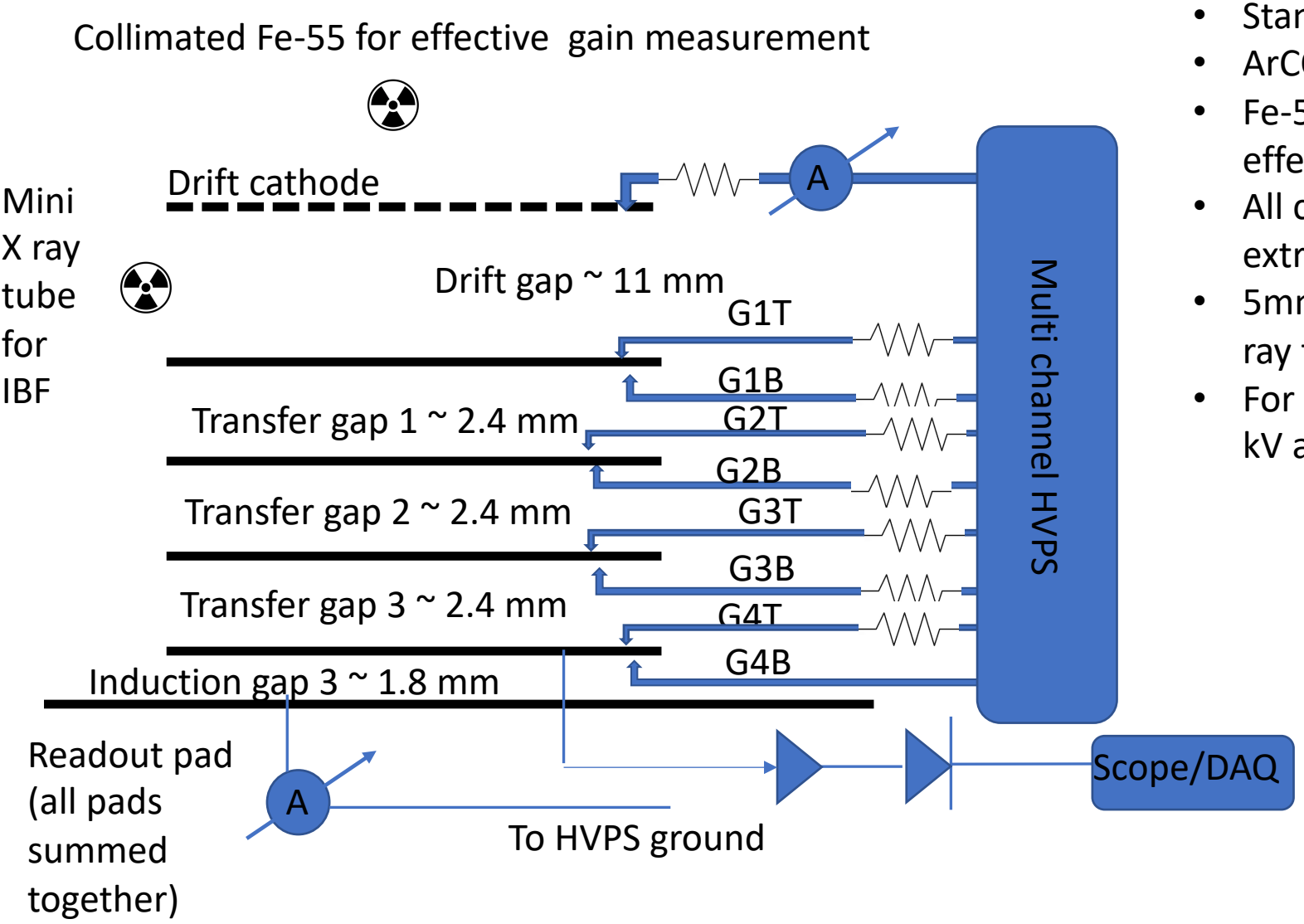
VANDERBILT
UNIVERSITY

IBF measurement for Quad GEM detector



- Standard 10x10 GEMs
- ArCO2 (70:30) gas
- Fe-55 spectra taken from bottom of last GEM for effective gain calculation
- All channels of readout pad summed together to extract induced current from avalanche electrons.
- 5mm collimator for Fe-55 and 1mm collimator for X-ray tube
- For IBF measurement X-ray tube was operated at 20 kV and 15 uA.

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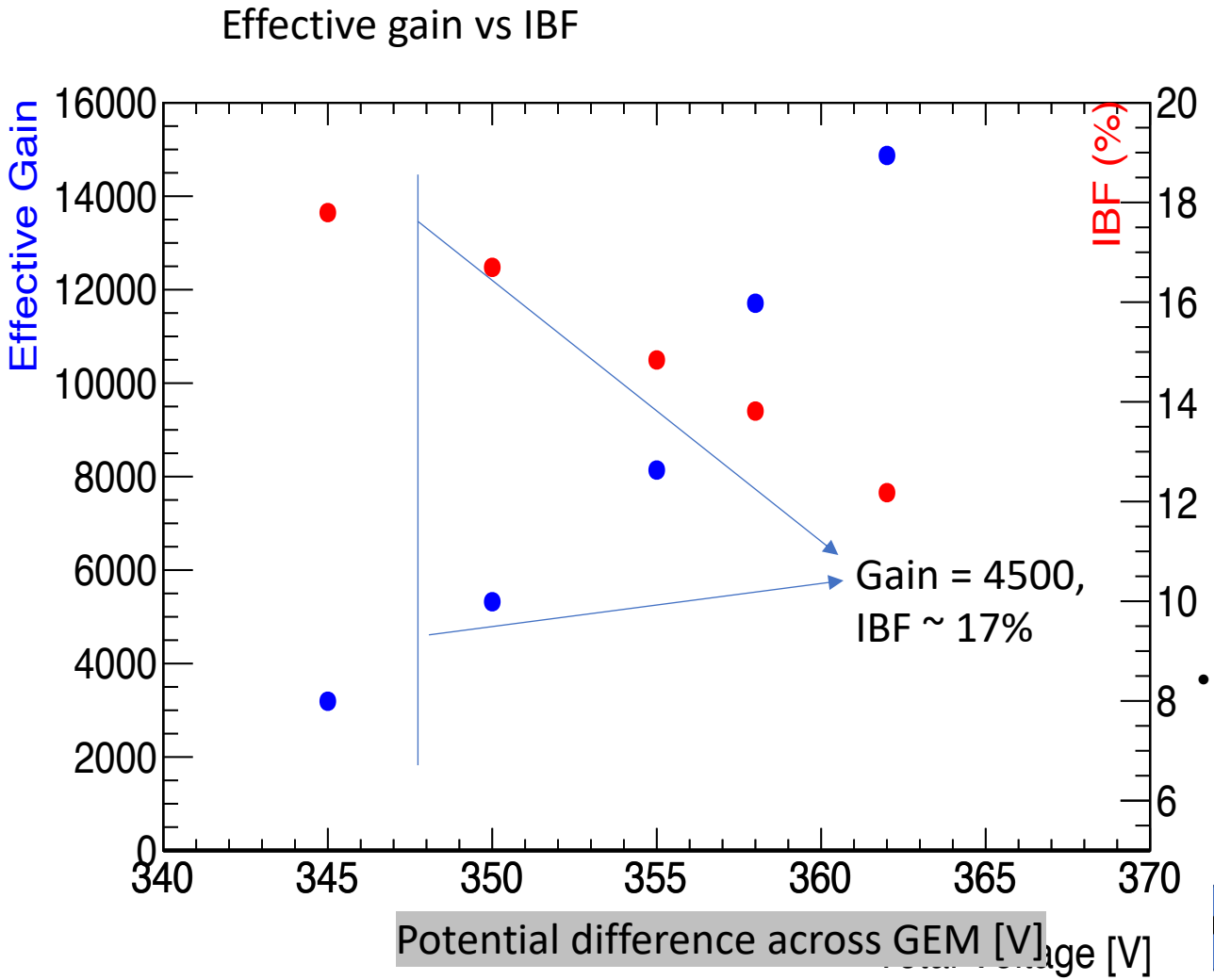

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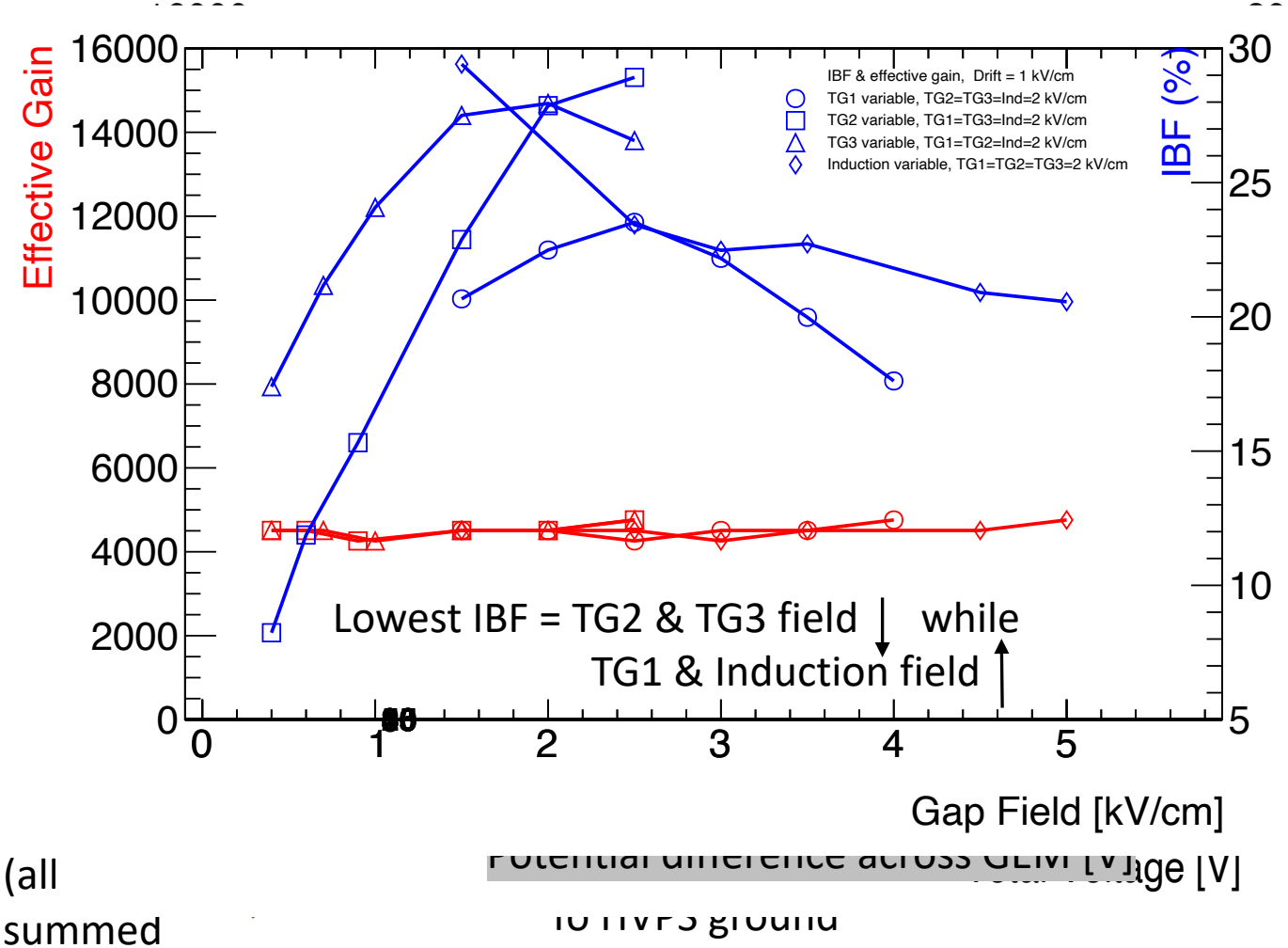
IBF measurement for Quad GEM detector

IBF = Cathode current / Anode current



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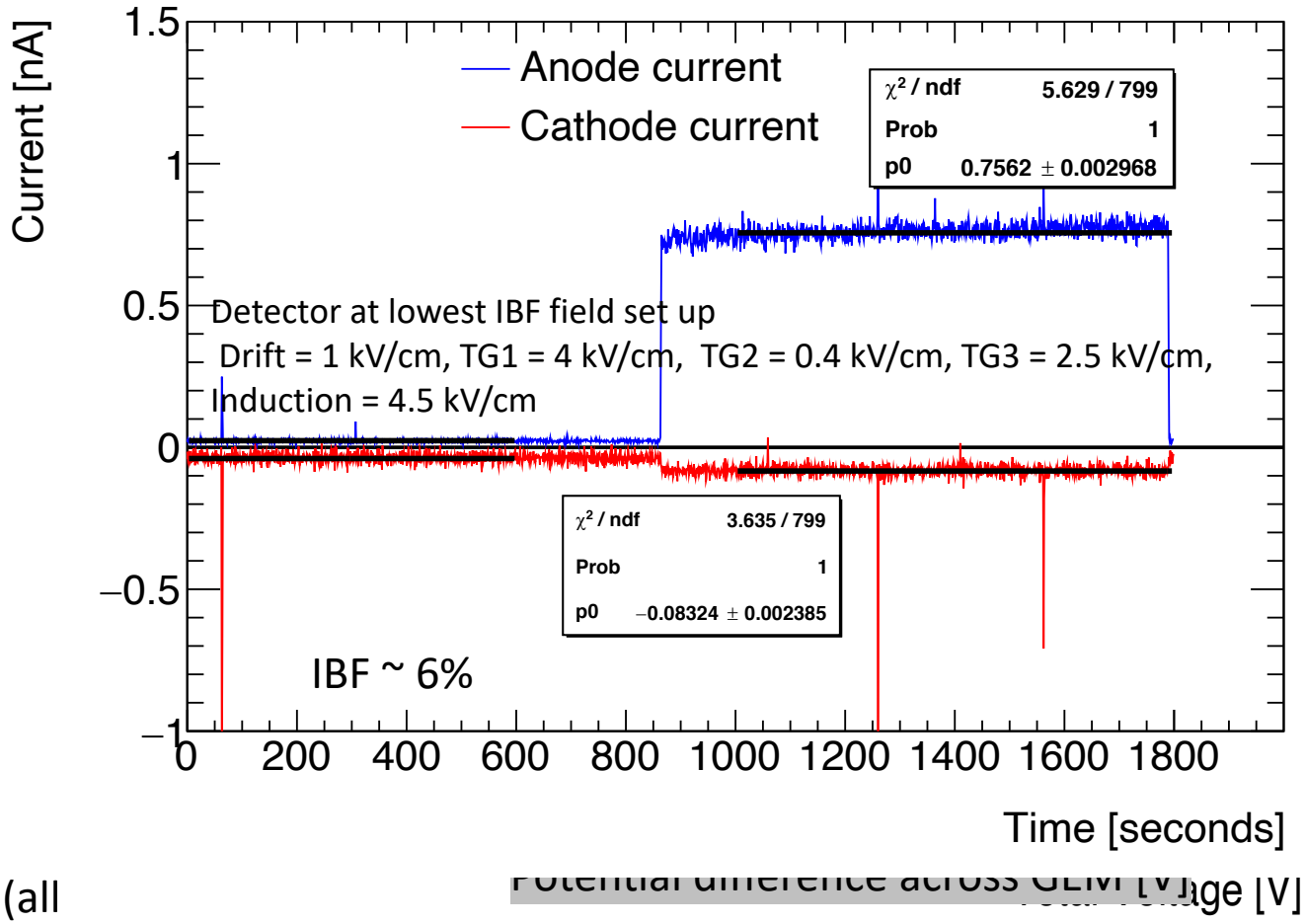

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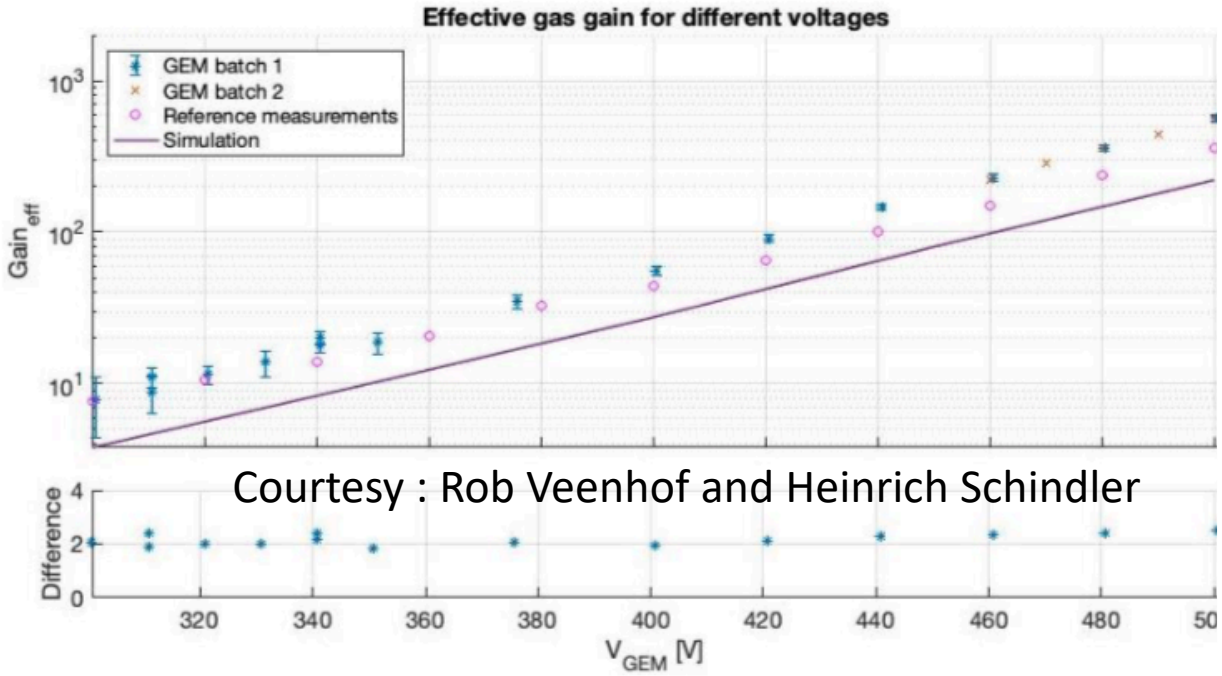
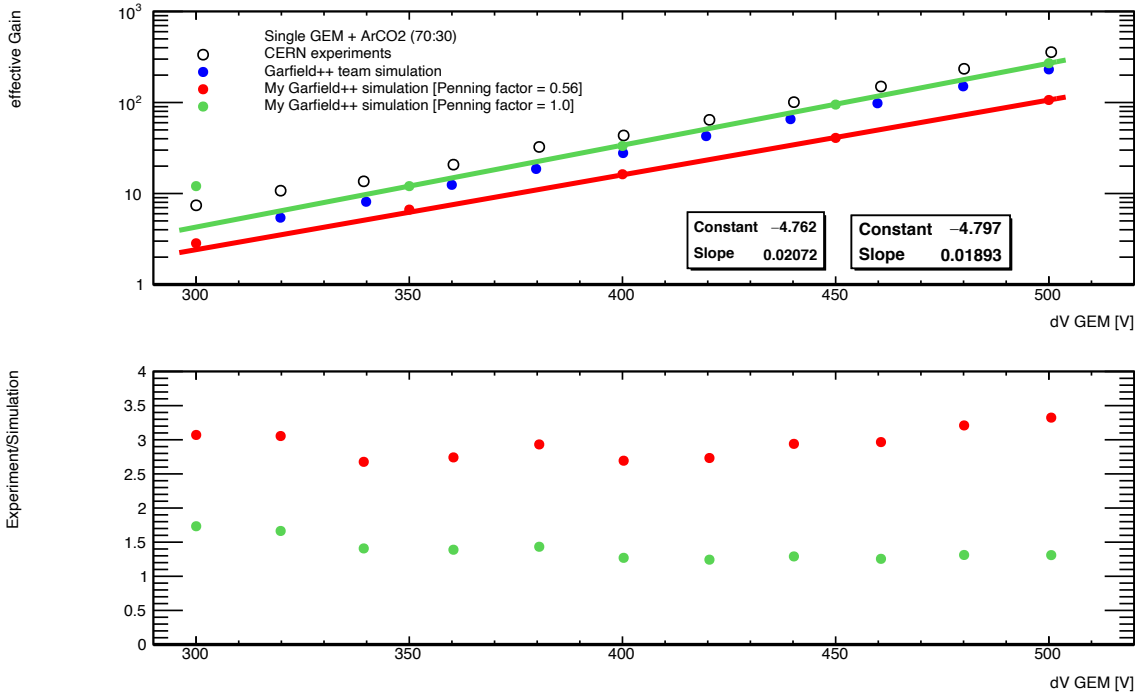
Data and simulation discrepancy , single GEM

Single GEM simulation and experimental result for ArCO2 (70:30) gas , Penning coefficient for Ar = 0.56



Courtesy : Rob Veenhof and Heinrich Schindler

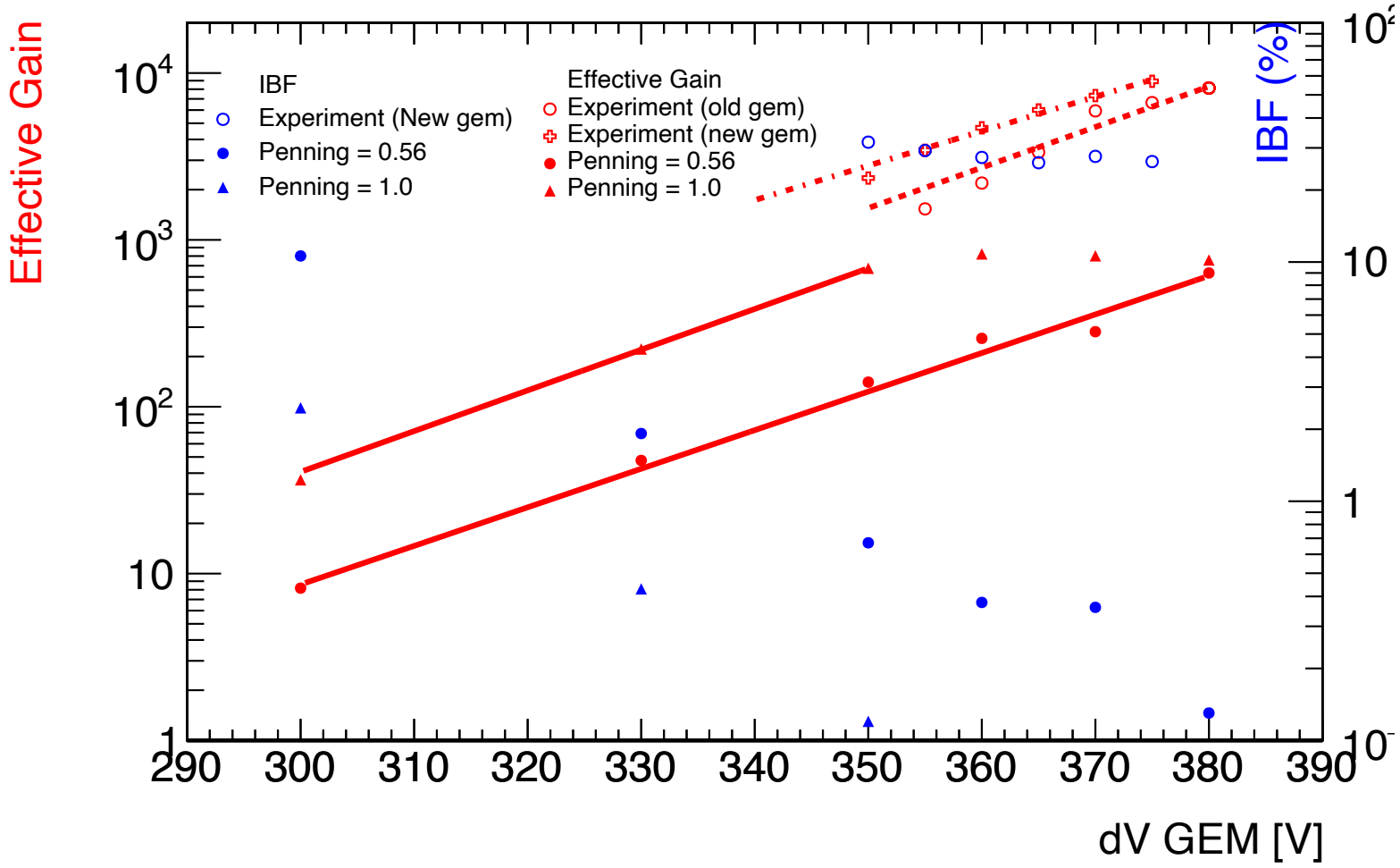
Overlay of CERN result and my simulation for ArCO2(70:30) using Penning coeff. Of 0.56 and 1.0



Note : Using Penning coefficient of 1 is not right even if it shows better agreement with experiment

Data and simulation discrepancy , triple GEM detector , ArCO2(70:30)

Experimental data is from Vanderbilt University



- IBF from both simulation and data show the same trend.
- Probably we cannot do quantitative comparison between data and simulation but qualitative comparison is possible.
- Discrepancy between data and simulation is probably because not taking into account of charge up effect of GEMs in simulation which tends to enhance the effective gain as per Garfield++ authors.
- Need to try iterative procedure to take into account GEMs change up effect .